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ADDITIONS TO THE PLEISTOCENE FLORA OF NEW JERSEY*

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No very promising localities for Pleistocene plants have thus far been discovered in the New Jersey area. The long-known and justly-celebrated Fish House clays in Camden county have yielded a considerable Pleistocene fauna, both vertebrate and invertebrate; and vegetable remains are not uncommon in the clays, but they are poorly preserved and difficult or impossible to determine. The writer has previously mentioned the presence at this locality of fragmentary maple leaves, seeds of the gum, and leaves of the linden, the latter occurrence having been described in a previous issue of *TORREYA*.† Still other seeds are present but they have not been identified.

Another New Jersey locality for Pleistocene plants was discovered by H. S. Gane in 1892 while working for the U. S. Geological Survey under the direction of Prof. W. B. Clark. The writer has not visited this locality, which is near Long Branch in Monmouth County, and such of the following notes as refer to this locality are based upon a small collection of the impure peat made at that time. The late Pleistocene age of these deposits near Long Branch has never been questioned, but there has been considerable divergence in the age assigned to the Fish House clays at different times. The following brief enumeration will give a good idea of the varying opinions which have been held regarding the age of these beds. Lea, Cook, and Whitfield regarded them as Cretaceous and of the same age as the Amboy clays; Cope at one time regarded them as Pliocene but later

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†Berry, *Torreyia*, 7: 80, 81. 1907.

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concluded that they were Pleistocene; C. A. White in 1883 considered them post-Tertiary; Carville Lewis in 1884 considered them to be inter-glacial in age; R. D. Salisbury in 1894 regarded them as post-Pensauken but in 1895 and since has included them in his Pensauken formation; Pilsbry in 1896 says that they are inter-glacial or pre-glacial, probably the latter; Woolman in 1896 referred them to the Pensauken; and Shattuck in 1906 correlates them with the Talbot formation of Maryland. In the judgment of the writer the fossiliferous stratum at least is not older than the last interglacial and the probability is strong though unverified that it is post-glacial in age. The same remark is applicable to the fossiliferous peat near Long Branch which has yielded seeds and fruits of a number of different species of plants.

While the present collections are too small for any very definite conclusions regarding the climatic conditions which were prevalent in this latitude at the time these plants were living, it is significant that of the nine forms enumerated only three are species which in the recent flora range from Canada or New England to Florida. These are *Juniperus virginiana*, *Hicoria glabra*, and *Vitis aestivalis*; and in all three cases the New Jersey Pleistocene forms are not as conclusively determinable as would be desirable. Of the remaining six species, *Quercus Phellos* is the only one which in the existing flora extends northward beyond this Pleistocene occurrence and then only for a few miles. The others all have their present day northern limits of range considerably south of their northern limits in the late Pleistocene. *Nyssa biflora*, *Vitis rotundifolia*, and *Taxodium distichum* do not range northward beyond southern Maryland at the present time, while *Pinus Taeda* is said to find its northern limit in Cape May County, N. J. *Zizyphus* is not represented at all in the northern or central coastal plain at the present time and is mainly tropical in its distribution. These facts though few in number and coupled with a certain lack of precision regarding the exact age of the deposits are of considerable interest since it is a well-known fact confirmed by abundant and conclusive evidence that in Europe the last glacial retreat was succeeded by a period during

which the climate was considerably warmer than it is at the present time as shown by the extension of various members of the existing flora for many miles to the northward of their present range.

The writer gratefully acknowledges his indebtedness to Mr. W. L. McAtee of the Biological Survey who through the courtesy of Dr. C. Hart Merriam has examined not only some of the present specimens but also other Pleistocene fruits and seeds collected by the writer. The Biological Survey in its extensive studies of the stomach contents of birds and mammals has accumulated large collections of fruits and seeds as well as experience in the identification of materials of this sort which is invaluable to the student of swamp deposits like so many of our Pleistocene plant-bearing horizons.

The following notes refer to the forms from New Jersey which have been recognized in the present study.

Taxodium distichum (Linné) Rich.

- Holmes, Journ. Elisha Mitchell Soc. for 1884-85: 92. 1885.
 Hollick, Md. Geol. Surv. Pli. & Pleist. 218, 237. *pl.* 68. 1906.
 Berry, *Torreya*, 6: 89. 1906. Journ. Geol. 15: 339. 1907.
 Amer. Nat. 43: 434. *f.* 1, 2. 1909. Amer. Journ. Sci. (iv),
 29: 391. 1910.

In the existing flora the cypress reaches its northern limit in southern Delaware and Maryland. Its range is becoming gradually restricted in the coastal plain as is shown by the sub-fossil occurrences of stumps north of the present limit of pure stands.

In the late Pleistocene its range was much more extensive and fossil remains are found at numerous localities north of its present limit of distribution. The most northerly of these occurrences is the present record based upon cone-scales from near Long Branch, N. J., which is nearly 200 miles north of the present northern limit of the species.

Pinus Taeda Linné.

- Berry, Amer. Journ. Sci. (iv), 29: 391. 1910.

Cones and seeds of this species were recorded recently from the Pleistocene of both eastern and western Alabama. In the

existing flora the Loblolly pine becomes confined to the coastal plain north of the Potomac River valley, although to the southward it spreads over the Piedmont plateau and into the Appalachian region. It is found as far north as Cape May County, N. J., but the most northerly pure stands are in southern Delaware and Maryland on the sandy soils derived usually from the Pleistocene formations.

The present occurrence is based upon seeds from the swamp deposit near Long Branch, N. J., indicating that this species extended at least 75 miles farther northward in the late Pleistocene than it does at the present time.

Juniperus virginiana Linné (?).

Seeds of a *Juniperus* closely resembling those of this species occur near Long Branch, N. J. They are queried since from fossil wood in the possession of the writer collected from the

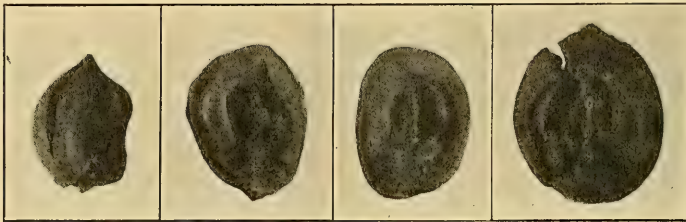


FIG. 1.—Nuts ($\times 1$) of *Hicoria glabra* from Long Branch.

Pleistocene of Maryland it is clear on anatomical grounds, that an extinct species of *Juniperus* was present in the northern coastal plain and these seeds may possibly be those of that species. The present identification was suggested by Mr. McAtee.

Hicoria glabra (Mill.) Britton (?).

Mercer, Journ. Acad. Nat. Sci. Phila. (ii) 11: 277, 281. f. 4, 5, 12, 16. 1899. (*Carya porcina* Nutt.)

Berry, Torreya, 6: 89. 1906. Journ. Geol. 15: 340. 1907. Torreya, 9: 97. f. 1-5. 1909.

This species has a wide range in the existing flora of eastern North America and it is also frequently met with in the Pleistocene, having been previously recorded from deposits of this age in Pennsylvania, Maryland, Virginia, and North Carolina. The

present specimens, a number of which are here reproduced, come from near Long Branch, N. J. They resemble somewhat *Hicoria microcarpa* but are larger and thicker shelled. They also show some points of resemblance to *Hicoria villosa*, a comparatively recent segregate from *Hicoria glabra*. On the whole they are closest to the latter species especially to those fruits of the latter which are more symmetrical and not ficiform in shape. They are queried since it is possible that they may represent some intermediate or ancestral form.

Quercus cf. *Phellos* Linné.

Berry, Journ. Geol. 15: 342. 1907. Amer. Nat. 41: 694.
pl. I. f. I. 1907. Amer. Jour. Sci. (iv), 29: 394. 1910.

This oak is a common species of the Carolinian and Louisianian zones ranging from southern New York to Florida and Texas. It is a common fossil in the North Carolina Pleistocene and has also been recorded from the Pleistocene of Alabama. The present occurrence is based upon somewhat flattened cupules from near Long Branch, N. J., whose specific identity is not established with entire certainty. In the same deposits the writer has found a number of immature *Quercus* fruits four to five millimeters in diameter which may belong to this same species.

Vitis pseudo-rotundifolia sp. nov.

Seed relatively slender, curved, pointed: Surface slightly wrinkled: Inner face flat; outer face full and curved: Raphe well marked: Length 6.12 mm: Width 3.20 mm.: Thickness 2.25 mm.

This species of *Vitis* is distinct from any existing species known to the writer. It resembles in its general proportions the seeds of *Vitis rotundifolia* Michx., but is much smaller and less rugose. If it represents an ancestral form of this species, as is not improbable, the range in the late Pleistocene was more extended than at the present time since *Vitis rotundifolia* finds its present northern limit in southern Maryland almost 200 miles south of the oc-

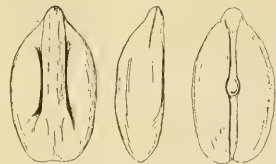


FIG. 2.—Three views of seed ($\times 3$) of *Vitis pseudo-rotundifolia* from Long Branch.

currence of *Vitis pseudo-rotundifolia* which is at Long Branch, N. J. Mr. McAtee who kindly compared this seed with the existing species reported that it was different from any of the existing species of *Vitis*.

Vitis cf. *aestivalis* Michx.

The summer grape is widespread in the existing flora of eastern North America ranging from southern New England to Florida along the Atlantic coast. The specimens from the Pleistocene near Long Branch, N. J., are seeds which agree fairly well with the existing species with which they have been compared.

Nyssa biflora Walt.

Hollick, Md. Geol. Surv. Pli. & Pleist, 235. pl. 69. f. 5. 1906.

Berry, Torrey. 6: 90. 1906. Journ. Geol. 15: 345. 1907.

Amer. Journ. Sci. (iv), 29: 398. 1910.

This species in the recent flora appears to be confined to the coastal plain ranging from Maryland to eastern Texas. According to Coulter & Evans it occurs in New Jersey, and Sudworth records it from the Piedmont plateau in Montgomery County, Maryland. However, the botanical survey of Maryland which has been completed recently failed to discover this species except in the river swamps of the southern "Eastern Shore" which it would seem marks its present northern limit. Britton & Brown state that perhaps it intergrades with *Nyssa sylvatica* which extends northward to Maine and Canada, but in any case the seeds are distinctive and it is upon the seeds that the present record at Fish House, N. J., is based. Gum seeds have been previously mentioned by the writer as frequent in the Fish House clays but these have never been specifically identified. As a fossil this species has been previously recorded from Maryland, Virginia, North Carolina, and Alabama.

Zizyphus sp.

The remains consist of a flattened drupe with a smooth stone from Long Branch, N. J. They are larger and more massive than those of the existing *Zizyphus obtusifolia* of the southwestern United States and differ from any of the existing species with which they have been compared. There is room for some doubt

regarding the correctness of the identification; the remains are, however, more like those of *Zizyphus* than anything else in the existing flora with which they have been compared either by the writer or by Mr. McAtee of the Biological Survey.

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TWO INTERESTING NEW ENGLAND PLANTS*

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During a brief visit around Oxford, Massachusetts, in September, 1910, I was much impressed with the pretty Spiked-Loosestrife [*Lysimachia terrestris* (L.) B. S. P.]. At this season in certain situations many plants had become strikingly conspicuous from the great numbers of deep red, elongated bulblets which were growing from the axils of the numerous, more or less distinctly whorled leaves. These bulblets, which morphologically are suppressed branchlets, may reach a length of $\frac{3}{4}$ of an inch, are very pointed and deep red in color. Late in the season these bulblets are very easily detached and thickly strew the ground beneath the plants.

In June and July the Spiked-Loosestrife produces an abundance of small, brown-marked, yellow blossoms in a terminal, pyramidal raceme. The plants, however, are far more noticeable in autumn when they have become reddened with their axillary bulblets, which at first sight resemble peculiar little fruits more than anything else. Conditions of environment seem to determine whether the plants will produce these bulblets abundantly or not. Many botanical descriptions of *Lysimachia terrestris* make little or no mention of this well-marked habit of the plant to produce axillary bulblets.

The Narrow-leaved Laurel (*Kalmia angustifolia* L.) is a low, evergreen shrub thriving in pastures throughout New England. During its growth it forms small tufts which, in the course of years, if the conditions of growth have been uniform, may form great circular areas many feet in diameter. This peripheral extension is probably accomplished by a process of budding from underground shoots.

*Illustrated with the aid of the Catherine McManes fund.